

Wednesday, September 14, 2011

Exams, Sky Watch back, key posted on web site. We keep the scantrons. Check that your grade is correct.

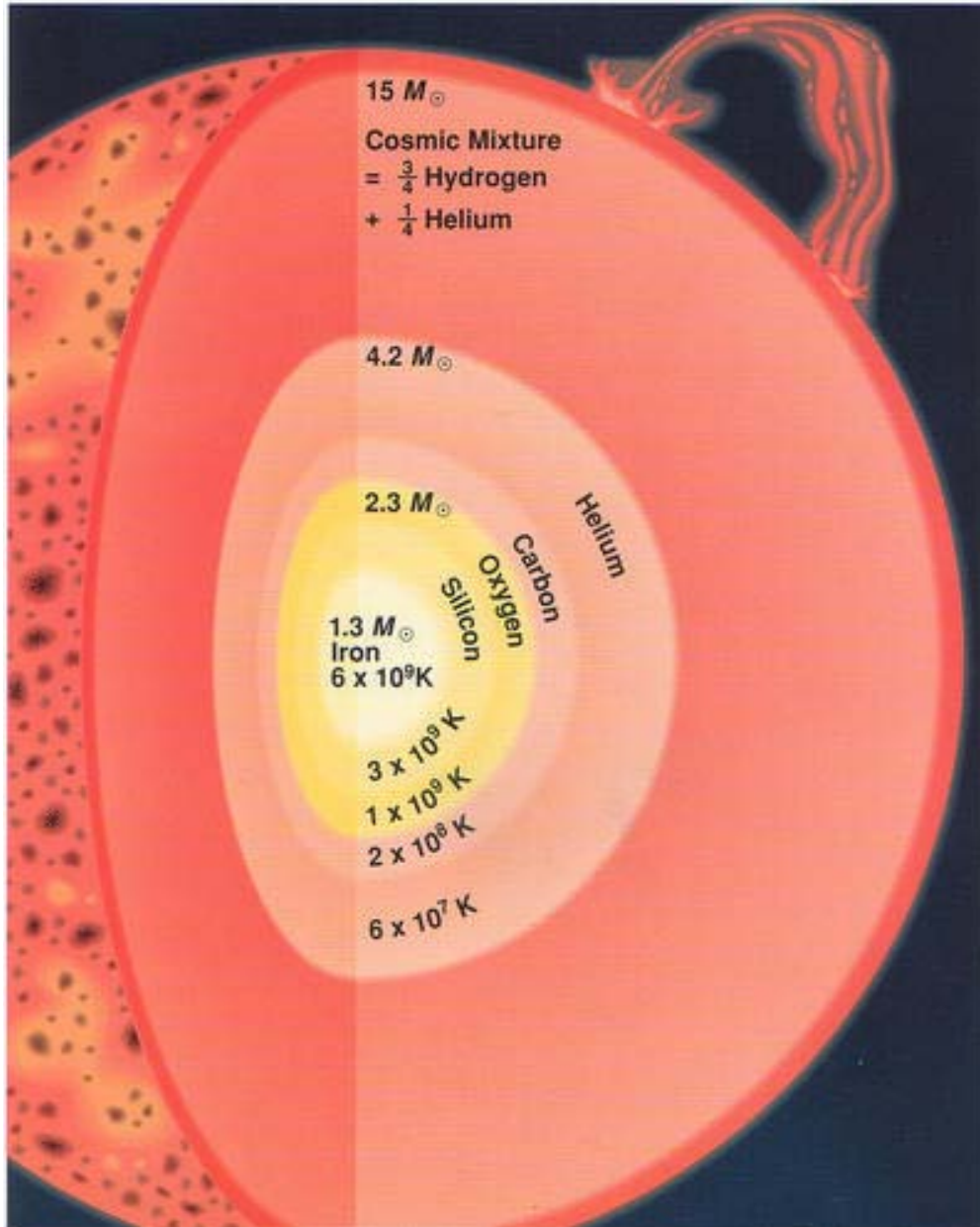
Astronomy in the news? Russian rocket to International Space Station postponed to November 12 after crash a few weeks ago. Crew must leave (by capsule already at ISS) by November 19 if not resupplied.

Pic of the day: open star cluster M52 with 1000 stars and more distant Bubble Nebula blown by winds from single massive star.



Goal

To understand how a massive star gets from hydrogen to iron, and why iron?



Origin of Type II, Ib, Ic

How does a massive star get from hydrogen to iron, and why iron, and what then?

Discussion point:

What do you know about iron?

Evolution - gravity vs. charge repulsion

§ 2.1

Discussion point: Why do you have to heat a fuel to burn it?

$H \rightarrow He \rightarrow C \rightarrow O$

more protons, more charge repulsion,
must get ever hotter to burn ever
“heavier” fuel

Just what massive stars do!

Support by thermal pressure.

When fuel runs out, **core loses energy**,
but gravity squeezes, core contracts and
HEATS UP

overcomes higher charge repulsion, burns
new, heavier fuel, *until get to iron*

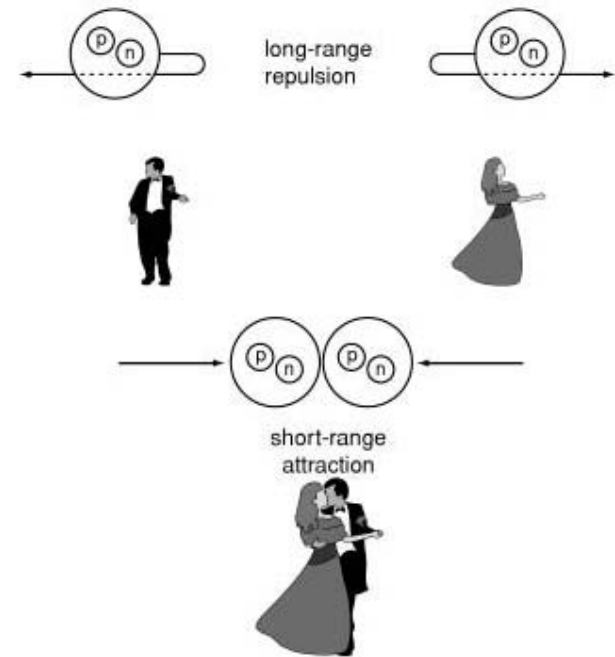
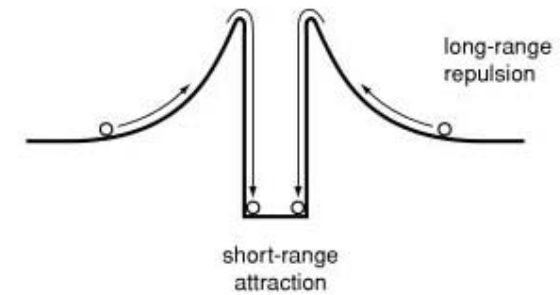


Figure 2.1

Make succession of heavier elements

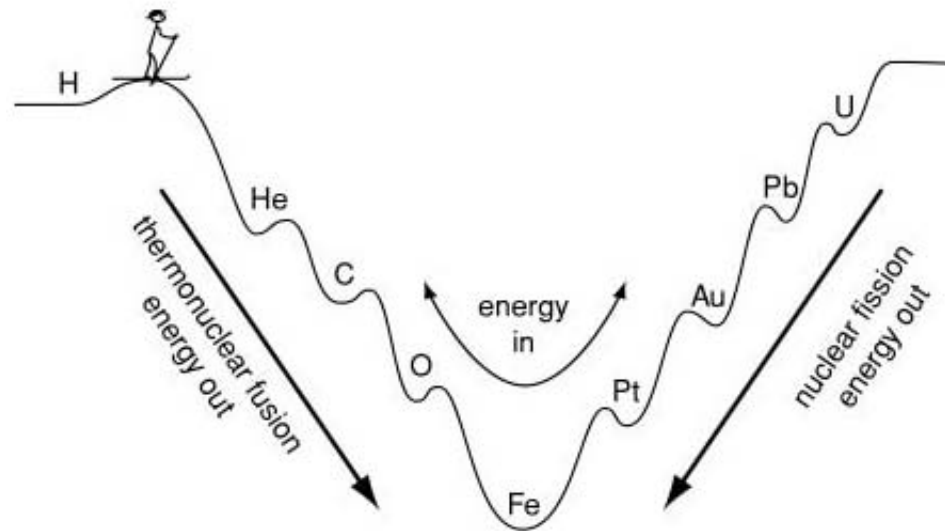


Figure 2.3
measure of
binding
energy of
protons and
neutrons in
the atomic
nucleus

Special role of Iron - 26p, 30n, most tightly bound arrangement of protons and neutrons.

Endothermic - must put energy in to break iron apart into lighter elements or to forge heavier elements. Irons absorbs energy, lowers pressure, core contracts, iron absorbs more energy, more contraction...

=> The iron core quickly collapses! Catastrophic death of the star.

One minute exam

Why do you have to heat a nuclear fuel to make it burn?

 Charge repulsion keeps nuclei apart

 The strong nuclear force keeps nuclei apart

 To break chemical bonds

 To make neutrons

Goal

To understand what happens after a massive star forms an iron core

Iron core of massive star absorbs energy.

When iron core forms - star is doomed to collapse.

Iron core collapses in about 1 second to form a ***neutron star*** (or maybe a black hole), composed essentially of all neutrons.

Neutrons formed when protons and electrons combine.

$p + e \rightarrow n + \nu$ ***neutrino***,

Action of Weak Nuclear Force (Chapter 1.2)

One ν is generated for every p that is converted, a star's worth of protons

\Rightarrow ***lots of neutrinos***